Swaine] [*New Bond St. W.*

DR. A. F. STANLEY KENT (1918)

INTRODUCTION

R. J. BROCKLEHURST, M.A., D.M.
(*Professor of Physiology, University of Bristol*)

DR. STANLEY KENT graduated at Oxford in 1886 and demonstrated in Physiology at Manchester, Oxford and St. Thomas's Hospital before coming to Bristol in 1899. He was the first full-time Professor of Physiology in University College and, from 1909, the University of Bristol. He had the important task of developing the accommodation, teaching and research in his subject, and there can be no doubt about the energy with which he proceeded. In addition to his work on the heart, for which he is famous and which covered several years, he had wide scientific interests. He had played an important part in developing the X-ray Department at St. Thomas's Hospital; he founded a Clinical Research Laboratory in Bristol and directed it for some years, and he was lecturer in Bacteriology and Bacteriologist to the Royal Infirmary. It was largely through his wise foresight and energetic advocacy that steps were taken to found this University.

In 1918 he was attracted away to Manchester to direct a Department of Industrial Administration at the Municipal Technical College, and he published some important papers on industrial fatigue and kindred subjects.

I have not had the privilege of knowing Dr. Kent as closely as have some of the other contributors to this number; but about the time of my appointment to the Chair of Physiology I received a letter from him, then living in retirement at Iron Acton, warmly welcoming me to Bristol. In it he referred to the friendship between himself and Professor Buckmaster, his successor and my predecessor, who had incidentally been one of his teachers in his undergraduate days at Oxford, and expressed pleasure at the continuation of the line of Oxonians in the Chair. I used to see him and Mrs. Kent from time to time in their delightful home at Iron Acton, a room of which he had converted into a laboratory where he energetically continued his histological work, and elsewhere, until he moved to Wiltshire, and I shall always remember his kindness to the youngster who had come to fill the post he had vacated twelve years previously.

And now Dr. Kent is rapidly approaching his ninetieth birthday. Since the death of Sir Charles Sherrington last year at the age of ninety-four he has held the distinction of being the senior member of the Physiological Society, to which he was elected in 1887. It is fitting that THE BLACK BAG should honour him; he has our congratulations and best wishes.

EARLY DAYS IN BRISTOL

A. F. Stanley Kent, M.A., D.Sc.(Oxon.)

It was in the Autumn of 1899 that I was appointed to the Professorship of Physiology in University College, Bristol. Before my appointment there had been no whole-time Professor, but the work of the Department had been shared amongst the Medical Practitioners of Clifton.

I found the accommodation meagre—a lecture room, a room fitted with benches with frames for chemical reagents, and a tiny box-like room known as a Preparation Room. A private room for the Professor was provided by turning the students out of their Common Room, to their great annoyance. Of apparatus there was little—three or four microscopes, a recording drum, and a sphygmograph; so the instruments I had brought with me proved of the greatest value. The staff consisted of half a man, that is to say, one man shared between the Departments of Physiology and Anatomy; his mornings were devoted to Physiology and his afternoons to Anatomy. Before my arrival the duties of Demonstrator had been carried out by Mr. Chilton, and the students must have felt his loss greatly when he retired.

The College at that time consisted of two blocks—the Medical School, and the Arts and Science block. The Medical School contained the Medico-Chirurgical Society's museum and a few other rooms on the ground floor in front, together with the Library and Physiology lecture room and laboratory on the first floor. The Dissecting Room and Lecture Room of the Anatomy Department were in the rear. The Arts and Science building was placed higher up the hill. Beyond occasional visits to the administrative offices in the Arts and Science building there was little communication between the two blocks, and it was a long time before I could recognize all my colleagues, even by sight. There was no club or luncheon room, and most of the staff were accustomed to go home for the mid-day meal. The two Faculties met separately, and the only common ground was afforded by the very occasional meetings of Senate.

Such a state of things was unfortunate and rendered progress difficult. The atmosphere existing between the different Departments may be judged by an incident which occurred when it was suggested that the Physiologist should sit on the Science Faculty. The suggestion was strongly opposed by a member of that Faculty on the ground that Physiology was a purely medical subject, and had nothing to do with science.

This was not promising soil on which to plan a University, yet the effort had to be made, and at the March meeting of Senate, 1900, a motion was brought forward :—

"That a Committee be formed with the object of doing everything possible to promote the formation of a University for Bristol and the West of England."

The suggestion was received with derision by some members, with quiet contempt by others. Only one—Walter Swayne, Professor of Gynæcology—supported it, and seconded it: the other members allowed it to pass as the fantastic dream of a visionary.

But the motion was now a resolution, and it was necessary to appoint a Committee. Only Walter Swayne was willing to serve, and therefore the two Deans, Lloyd Morgan and Markham Skerritt, were added in virtue of their office. Thus the Committee consisted of :—

Lloyd Morgan, Dean of Arts and Principal of the College.
Markham Skerritt, Dean of Medicine.
Walter Swayne, Professor of Gynæcology.
A. F. Stanley Kent, Professor of Physiology.

Its terms of reference were certainly extensive, and somewhat vague, but the first thing seemed to be to familiarize the people of the neighbourhood with the idea of a University in their midst, and to inform them of the advantages which might accrue to them personally. For the West Country people, though perhaps slower in thought than those of the North, are yet keenly alive to anything that may concern their own welfare. The work was rendered more difficult by the fact that a sort of "cold war" existed between the population of Clifton on the one hand and the population of Redland on the other. It was necessary to interest both sets of persons and, if possible, to bring them together.

Amusements were scarce at that time, and it was considered that a series of popular public lectures might bring the College into notice and also form a meeting ground for Clifton and Redland. The public lectures were popular and the Departments responded well to the call. Geology, Botany, Zoology contributed, and one of my own lectures was entitled "Nature's Way"—being devoted to showing how Nature, unaided, contrives to bring about effects that Man needs apparatus to achieve. These lectures were largely attended and no doubt did much to bring the College before the public eye. They also showed the value of scientific knowledge applied to practical problems, and soon appeals for help were coming in from farmers and others in large numbers. Help was sought in such matters as soil fertility, manures, fruit and vegetable culture, pests, and diseases of stock and poultry. I well remember one morning arriving at the laboratory to be greeted by five dead young turkeys, spread out on the table before me. There was an epidemic, and help was sought in dealing with it.

The appeals for help reaching the College were varied and often needed attention from more than one Department as, for instance, in the case of the Scouring Lands of Somerset, and it was felt that some coordination of activities was called for. Accordingly the Departments that had been helpful were collected into a group, and the Committee (or Department) of Economic Biology was formed. Later, when money became available, this Committee formed the nucleus of the Agricultural Research Station at Long Ashton, in association with the National Fruit and Cider Institute.

But more serious propaganda was needed.

The Medical Officer of Health, Dr. Davies, was fully occupied with routine work, and found it difficult to cope with the rapidly increasing demands in connexion with bacteriological diagnosis of such diseases as tubercle, typhoid and diphtheria. To ease matters he had taken into his laboratory for training one of his out-of-doors inspectors, and with this man's help had been able to get through the work. He was, however, glad when he learned that someone who could help him had joined the College.

About the same time the B.R.I. lost their bacteriologist, and I was asked to take up the duties. The accommodation was primitive, but the requirements elementary, and after a time it was found possible to devote a small space to the arrangement of a laboratory, and Sir Frederick Treves was kind enough to come down and open it.

The hospital was also advancing on similar lines.

The increasing attention being devoted to the diagnosis of disease by bacteriological methods, and the increasing demands of the medical practitioners of the district, seemed to provide a fresh opportunity for the College to supply the means of meeting a public want. Accordingly I approached the Council with a suggestion that a Laboratory should be established to which doctors and others in all parts of the country could send specimens for examination and diagnosis. No such laboratory existed in the neighbourhood, and material sent to London for examination by Dr. Klein involved delay where promptitude was of first importance. The suggestion was not received very favourably. The Council was still troubled by the old difficulty with regard to experiments on animals, and though the local feeling on the subject had to some extent died down, it was judged unwise to risk its resurrection. But wiser counsels prevailed, and I was given permission to establish such a laboratory, but on the clear understanding that no financial responsibility whatever should fall on the College ; it was to be entirely at my own personal risk and expense.

The nature of the response to the establishment of the Clinical and Bacteriological Research Laboratory may be judged from the fact that for the Bristol Health Office in a six-week period at the end of 1902, 596 specimens were examined, and a sum of £121 6s. 6d. was received in payment. Fees were purposely kept low, especially for

Medical Officers and institutions. Arrangements were soon in existence with other Counties and District Authorities. The laboratory also provided an opportunity to those wishing to take a higher examination to learn some elementary bacteriology, and men travelled long distances once or twice a week to attend classes.

The Somerset County Council placed a sum of £200 at our disposal, and this was used to open a station at Chewton Mendip for the study of cheese making. One queer result was to explain why cheese made with the wind in a particular direction was never good. The pig styes were in that direction!

The next event in the history of the laboratory followed an outbreak of plague in South America. This, of course, did not affect us directly, but a ship sailing from an infected South American port and docking at Bristol might lead to a prolonged quarantine, with heavy costs to Bristol. This touched the business community profoundly, and once more the College was recognized as a likely help. Elaborate precautions were being taken by the M.O.H. Any ship coming from a suspected port was met and halted outside Avonmouth. Rats, very susceptible to plague, were taken and submitted to examination —the ship being detained until a favourable report was received.

The work of the laboratory continued to grow. The Public Health Authorities of Bristol and the surrounding counties were depending more and more upon our help, and the income derived from these activities was already considerable. The science of bacteriology was in its infancy, but the reliance placed upon it by the medical profession for diagnostic purposes was growing by leaps and bounds. In fact the enterprise had become a success, and the organization was working smoothly and efficiently—so much so, that the Council decided that "Private Enterprise" had had its day, and with much regret I handed it over to the College, which assumed responsibility for its future conduct.

I found myself suddenly deprived of a considerable income, and though a sum of £200 a year was offered as compensation this seems to have been lost sight of in a reshuffle of Professors' salaries, when mine was raised from £200 to £400 a year.

Research continued as opportunities occurred. My work on the heart demonstrated several channels of conduction between auricles and ventricles in the region of the A–V groove, and muscle was shown to exist at the base of the valves sufficient to render the " floating up " theory unnecessary. Cases of diabetes were treated on physiological principles, and I remember one young woman who was " scarcely able to crawl ", and after treatment was able to " run after a bus ". (The buses were horse-drawn in those days.) On one occasion Dr. Edgeworth handed me seven sovereigns as my share of the fee, which, however, was quite unexpected since it was the custom to place freely at the disposal of the profession all helpful results achieved by scientific work.

The Home Office was interested in some work on Industrial Fatigue, and for some months an investigation was carried on in several factories, mostly in the Midlands, to test the effect of long hours of work on the factory worker, and to discover means of lessening fatigue, and increasing output.

This does not pretend to be a history of the University, but merely notes on the experiences of one who happened to be on the spot at the time of its inception and was able to take part in its development.

AN APPRECIATION

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MY first encounter with Dr. A. F. Stanley Kent, first Henry Overton Wills Professor of Physiology in the University of Bristol, was in September, 1912. The University Charter was then only three years old and as a young student, not too brilliant at mathematics, I was seeking his aid by asking permission to be allowed to substitute physiology for mathematics in the course for Final B.Sc. This permission was readily given in a gracious and courteous manner, which I ever afterwards associated with Dr. Kent. He seemed receptive to new ideas and anxious to develop his department, then just newly equipped, and in the planning of which we understood he had had a major share.

It had typewriters when such instruments were scarce and also housed one of the earliest Electrocardiographs—an Einthoven String Galvanometer for which a room with special foundations had been built to minimize vibration. It was a very "temperamental" machine, Dr. Kent being about the only person who could produce satisfactory tracings from it. If a string broke, gloom descended on the department for some days, only to be removed when a new string arrived.

A red letter day occurred for me some twelve months later when the Professor asked me to help with some experiments he was undertaking on behalf of the Home Office into "Industrial Fatigue". This involved making visits to various industrial undertakings during vacations and carrying out estimations of "Reaction Time", Blood Pressure, visual and auditory tests before and after shifts of work. The conception went back as far as 1903 when, at the International Congress of Hygiene and Demography held in Brussels, a resolution was passed that "the various governments should facilitate as far as possible investigation into the subject of Industrial Fatigue." The bearing of this subject on accident incidence, excessive sickness, monotony of work and output were emphasized, not forgetting the

effect of doses of alcohol on muscular activity and mental fatigue. Such was the peaceful background of those days, but when war broke out Dr. Kent at once took charge of the rifle range belonging to the O.T.C., and soon everyone was firing their tests and seeking to become more proficient in musketry. He also took part in the first camp the University organized in September, 1914, near the Jubilee Stone on the down above Barrow Gurney.

In the midst of these varying activities he managed to keep his work going and actually presented the first results in an "Interim Report on Industrial Fatigue by Physiological Methods" to both Houses of Parliament on August 17th, 1915.

So far I have made no mention of Dr. Kent's outstanding work on the heart, for he it was who first described the bundle of Kent and His—a muscular band, containing nerve fibres, connecting the auricles with the ventricles of the heart and conveying stimuli from the auricle to the ventricle. Degeneration of this bundle produces heart block, and in the years of which I write he had also demonstrated other nodes which could act as paths for stimuli. The various staining methods he used were ingenious and to make the histology more convincing, he demonstrated experiments on decerebrate animals, showing conduction of impulses when all but the smallest nodes had been divided.

The late Sir Charles Sherrington often visited him, and as late as 1917 was the external examiner in Physiology for the University.

From 1916 onwards, after the foundation of the Ministry of Munitions under Lloyd George, Dr. Kent's work on Industrial Fatigue assumed greater importance. He visited many of the newly established munitions factories at such places as Pembrey in South Wales, Wareham and Gretna-Green, and had the satisfaction of seeing output stimulated by the ideas put forward. Other factories and even coal mines were not forgotten, whilst experiments were also carried out in Surgical Dressings Factories and engineering works.

After the war, in 1919, Dr. Kent was invited to found a Department of Industrial Administration in Manchester and it was at this time that my personal association with him ceased. To establish the work he had so vigorously pioneered, he resigned his Professorship in the University and went to Manchester.

Industrial medicine, in my view, owes a great debt to Dr. Stanley Kent, who, well ahead of the times, saw clearly its great value and importance. Quoting from a "blue book" which he presented to both Houses of Parliament on August 16th, 1916, ". . . it was possible to obtain information upon . . . such [matters] as the need for the provision of canteens in munitions factories, the question of the proper feeding of the factory worker, the provision of accommodation in factories for the changing and drying of shoes and clothing, and the proper use of appliances provided for ventilating the workrooms."

Many of these things are now accepted as essential in the ordinary factory and the welfare workers of today may not realize that their functions all grew from these early conceptions.

Few pioneers live to see the full fruition of their labours and we rejoice that Dr. Stanley Kent is still with us. This century has been called the century of the common man, but let us remember that the benefits the common man enjoys come invariably from the efforts of the " uncommon man " of whom the subject of this short article was certainly one.

FURTHER REMINISCENCES

It was in 1912 that I had an interview with Dr. A. F. Stanley Kent (then Professor Kent) regarding a post as Laboratory Technician. Apart from the A–V Bundle, Dr. Kent felt that yet another path of conductivity existed ; it was for this research that I was appointed. Whether or not the reader refers to the bundle as that of " Kent " or " His " depends at which school he acquired his knowledge of Physiology.

Dr. Kent had a keen sense of humour, especially during lectures, and at practical physiology he was an ever present help. The whole of the departmental staff had the utmost confidence in him and this was reciprocated. This cordial relationship promoted an inspiring atmosphere. He was approachable by all and sundry, and was ever ready to give advice and help.

It was due to Dr. Kent that my future career as a Male Nurse was diverted to that of a Laboratory Technician in the Bristol Medical School, a post from which I have recently retired after thirty-eight years' service.

Another instance of his wise advice and counsel was when a Fresher from the North entered the University to commence a B.Sc. course and take a Diploma in Education. For assisting in Dr. Kent's work on " Industrial Fatigue " by physiological methods he was invited to " team up ". Arising out of this investigation he developed an intense appetite for Medicine, and through the kindly efforts and moral support of Dr. Kent he subsequently qualified and is now a Consultant instead of a Schoolmaster.

To Dr. Kent's foresight must go the distinction of obtaining the first electrocardiographic outfit in Bristol, for use in his effort to substantiate his belief. Up to the time of his resignation the ground covered in his approach to this all-important clinical problem was, both experimentally and histologically, encouraging, and one greatly regrets that the work ceased for another sphere which caused the loss to the University of a grand gentleman, an enthusiastic research worker and a patient teacher : such was the writer's experience.

W. S. Emery

Stanley Kent came to Bristol at a time when the Medical School very badly needed the services of a physiologist. The subject had been taught by a clinician who had no special interest in physiology and in any case had no gift for teaching.

The equipment of the laboratory was very poor, and students were discouraged because their experiments so often failed to come off. There was much discontent, and in those days medical students, all male, were dangerous animals when roused. A good many of them never got as far as the second M.B.

Stanley Kent came with an excellent record as an histologist. He had discovered the bundle of muscle connecting the auricle with the ventricle which came to be known as the bundle of His, but should by the law of priority have been called the bundle of Kent. Now both names are often dropped, and it is called the A–V bundle. He soon brightened up the equipment and the standards of teaching in the laboratory : there was only one in those days. As he had a good microtome that was really capable of cutting thin sections, a good many tumours and other tissues from the Infirmary were sent to him for an histological opinion.

He was a pleasant colleague who rendered the school good service, and he had no serious difficulty in improving the standards of discipline. Unfortunately, being almost single-handed for most of the time, in the routine of running his department, initiative in research was rather stifled, and he did not produce anything further of importance at that time. One can guess that the emoluments of a wholetime professor in the pre-university days were discouraging. Indeed, when the University was inaugurated, there was some difference of opinion as to whether–he should be continued in the chair. It would have been very ungracious if he had been dropped, and fortunately kinder and juster counsels prevailed.

One of the most important services he rendered to the University was the planning of the present physiology buildings with laboratories and lecture room. When it had been completed, other departments insisted that he had much more than his share of the accommodation available, and some parts of it, especially on the top floor, were rent out of his hand. When all is said and done, he has a clear claim to be remembered as the man who found the Physiology Department at a low ebb of efficiency, and left it in a condition to become a first-class going concern.

A. Rendle Short
(*Emeritus Professor*, *University of Bristol*)

THE HISTORICAL BACKGROUND

HARRY SOSNOWICK, B.SC., M.B., CH.B.
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IF we consider ourselves back in the last two decades of the nineteenth century, we find there is much discussion about the mechanism of the heart's action, just as nowadays there is much discussion about how insulin works, or what is the transmitting mechanism in sensory system synapses. A certain amount of knowledge seemed to rest on stable foundations. Since Harvey first performed the experiment, it was known that fragments of a cut-up heart would continue to beat, so that cardiac muscle was endowed with this ability as an inherent property. When the beating heart was observed in the open thorax, the orderly sequence of events of the cardiac cycle was striking, and gave rise to the suggestion that somewhere in the atria there was a pacemaker, which discharged periodically, with resultant spread of the impulse over the atria. The discharge of the pacemaker anticipated that of the atrial muscle, which thus contracted at the rate of the pacemaker, and not at its own intrinsic, but slower, rate.

There had been some discussion about whether the impulse originated in muscular or nervous tissue, and this discussion continued throughout the two decades. Even as late as 1904, Carlson gave very good evidence of neurogenic origin and conduction of the beat in the heart of the king crab, Limulus. But as early as 1882, Gaskell had studied the effect of temperature changes applied to the atria and ventricle of the frog heart, and showed that the beat began spontaneously, and was conducted by muscular tissue. If the rate of heart beat were dependent upon extrinsic nerves, and not due to an intrinsic pacemaker, an alteration in the excitability of cardiac muscle by temperature changes would not influence the *rate* of heart beat. Carlson's experiments were later criticised on the grounds that the heart of Limulus consists of striated muscle, which, unlike the vertebrate heart, can be tetanized. His findings are not, therefore, applicable to vertebrates.

Once the impulse had reached the atrial muscle, there was no difficulty in explaining its further transmission to the ventricle in the frog, for there was plenty of muscular tissue providing continuity between the two chambers. But it was known that the atria and ventricles of the mammalian heart were separated by a fibrous non-conducting ring, which acted as a bar to conduction. Many explanations on mechanical, nervous and electrical grounds were offered to account for the co-ordination between the upper and lower chambers. But none of these explanations satisfied, and some workers took refuge in the belief that the ventricles had their own initiator of beat, co-ordination being affected by nerves and nerve cells in the atrio-

ventricular groove. But there was evidence that these nerves and cells were not essential.

A. F. S. Kent examined the hearts of several mammalian species, and reported his results in 1892, although his paper was not published until the following year. His work rendered unnecessary all the vague hypotheses hitherto current, for he provided a very adequate explanation of the transmission of impulses from atria to ventricles.

From histological studies, he noted that embryo and newly-born mammals resembled the frog in that muscular tissue connected the atria and ventricles. As the animal grew, some of this muscle was replaced by fibrous tissue, but the replacement was never complete, a proportion of the muscle fibres always remaining intact. Furthermore, there was a second system of *specialized* conducting fibres, which, although present in such mammals as guinea-pigs and rats, was altogether better developed in monkeys. Kent writes: "Lying on the borderland between the undoubted muscle on the one hand, and the connective tissue on the other, and even penetrating the latter sometimes to a considerable distance, there may be distinguished cells which whilst certainly not belonging to the connective tissue, yet differ very markedly from the muscle fibres in the immediate neighbourhood. Briefly, these cells are usually spindle-shaped, nucleated, granular and often transversely striated, and are obviously a form of muscular tissue intermediate between ordinary cardiac tissue and plain or non-striated muscle."

Kent continues with a description of the course of these fibres, and of experiments on the living heart. He concludes that not only do the fibres carry the impulse from atria to ventricles, but they have the additional function of delaying the impulse, a view which is generally accepted nowadays.

In the year after Kent's work, that is in 1893, His also described the bundle, which is now named eponymously as the bundle of Kent and His. But the credit for prior description must go entirely to Kent.

The importance of this work can hardly be over-estimated. There could be little understanding, without a knowledge of the bundle, of heart block and many other cardiac irregularities. Much of Mackenzie's work on cardiac disease would therefore have been impossible. And electrocardiographic interpretation, so important in diagnosis, would not have progressed at all.

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H.S.

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THE WOLFF-PARKINSON-WHITE SYNDROME

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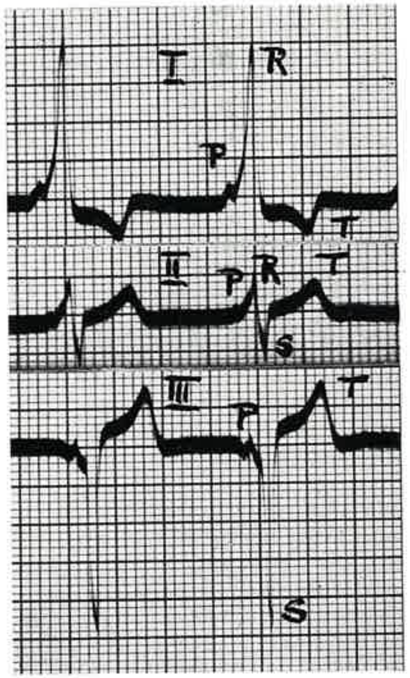
In 1892 Stanley Kent demonstrated to the Physiological Society that there were complete muscular connexions between the auricles and ventricles in new-born rats. He described such connexions in three situations: between the outer wall of the right auricle and the right ventricle, between the outer wall of the left auricle and the left ventricle, and between the septum of the auricles and the septum of the ventricles. He stated that in adult animals these connexions were not so well seen. He suggested that the contraction impulse was conveyed from auricle to ventricle by these structures and showed that retrograde conduction of the impulse could take place from ventricle to auricle (Kent, 1893). It is fairly clear that the last of these muscular connexions described by Stanley Kent is the auriculo-ventricular node and bundle, subsequently described by His, after whom it is so commonly called. Little attention was paid to Kent's claim that in young animals there might be more than one muscular bridge between auricles and ventricles despite the fact that in 1914 he published further studies on the "right lateral bundle" in which he stressed the fact that this bundle was composed of nerves and muscle fibres which were surrounded by a sheath of connective tissue and which were continuous with the muscle of both auricles and ventricles. He compared the structure of the lateral bundle to that of the neuromuscular spindle of voluntary muscle, and suggested that their function might be similar. He described experiments in which all connexion between auricles and ventricles were cut except at the site of the "right lateral bundle" and yet the heart continued to beat normally. Finally he claimed to have demonstrated the "right lateral bundle" in man and published a micro-photograph showing a clear muscular connexion between the right auricle and right ventricle (Kent, 1914 a, b). However, the auriculo-ventricular node and bundle of His had become so firmly accepted, supported as it was by the electrocardiographic work of Lewis, that little attention was paid to Kent's work.

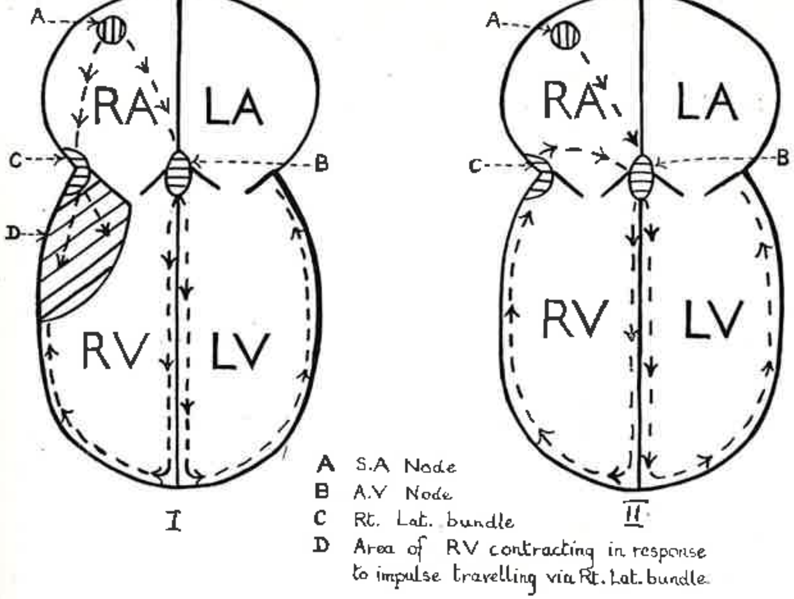
In 1930 Wolff, Parkinson and White drew attention to a curious electrocardiographic abnormality found in people with otherwise normal hearts in which the **QRS** complex resembled that found in bundle branch block but was preceded by an abnormally short **P-R** interval. Most of the patients in whom this abnormality was found were subject to attacks of paroxysmal tachycardia—usually supra-ventricular. If the heart rate is increased by exercise or by atropine the electrocardiogram as a rule reverts to normal. Further work soon showed that this Wolff-Parkinson-White syndrome, as it was called, or short **P-R** interval with bundle branch block, was not very rare. The fact that the time from the onset of the **P** wave to the end of the **QRS** is the same whether the complex is normal or shows the short **P-R** interval with apparent bundle branch block, proves that there cannot in fact be any delay in conduction and that the picture is caused by an *early* excitation of one ventricle.

Several workers suggested that the explanation of the Wolff-Parkinson-White syndrome might be the presence of the right lateral bundle of Kent which could transmit the impulse from the



Electrocardiogram showing the Wolff-Parkinson-White syndrome.

auricle straight to the right ventricle. With increased rates or with increased vagal tone the right lateral bundle might cease to conduct the impulse and the mechanism would revert to the normal pathway down the A–V node and bundle. This theory has been strongly attacked by Hunter, Papp and Parkinson (1940) who found a gradual change from the Wolff, Parkinson and White electrocardiogram to the normal, and various complicated and ingenious theories have been put forward to explain the phenomenon in other ways. However, the theory has been strongly championed, especially by Wolferth and Wood (1943).



Diagrams showing the possible mechanism of the Wolff-Parkinson-White syndrome if due to a "right lateral bundle."

I. The path of the impulse in the Wolff-Parkinson-White syndrome.

II. The mechanism of the paroxysmal tachycardia: An impulse reaching the ventricle by the A–V node re-enters the auricle via the "right lateral bundle." (After Wolferth and Wood, 1943.)

Naturally, attempts have been made to demonstrate the right lateral bundle anatomically and Glomset and Glomset (1940), in a study of mammalian hearts found various muscular bridges between auricles and ventricles in the A–V groove. In a patient known to have the Wolff-Parkinson-White syndrome, who died in a paroxysm of tachycardia, Wood, Wolferth and Geckeler (1943) found three muscular connexions between the right auricle and right ventricle, and in another case Ohnell (1944) demonstrated a muscular bridge connecting the left auricle and left ventricle. However, other anatomical studies have not been so successful. Butterworth and Poindexter (1942) successfully produced the short **P-R** interval with bundle branch block electrocardiogram in dogs by an artificial electrical conducting pathway between right auricle and ventricle. The action current from the auricle was picked up by silver electrodes, amplified and used to stimulate the ventricle. This clearly offers strong support to the theory that the Wolff-Parkinson-White syndrome is in fact due to the occurrence of an abnormal pathway between auricles and ventricles as described by Kent. Further, the paroxysm of tachycardia to which these patients are subject could be explained by a ventricular contraction initiated by an impulse from the auricles travelling down the normal A–V node and bundle sending an impulse back to the auricle via the lateral bundle, thus setting up a type of "circus movement". It must be admitted that despite the attractiveness of this theory, the experimental confirmation, and the demonstration in some cases of abnormal muscular connexion between auricles and ventricles, this theory has not received universal acceptance. Prinzmetal (1952) has recently stated that high-speed cinematography has shown that the essential disturbance in this condition is a premature localized contraction of a part of one ventricle followed by the normal contraction of the remainder of the ventricular mass at the normal time. This is what would happen if there were an abnormal auriculo-ventricular connexion. However, Prinzmetal stresses the fact that the chief function of the A–V node is to *delay* the passage of the impulse from auricle to ventricle and that if given cells of the A–V node supply particular regions of the ventricle the Wolff-Parkinson-White syndrome could result from accelerated conduction in one part of the A–V node. This, he claims, is what really happens. Nevertheless, whatever the true explanation of the syndrome may be, there is no doubt that in some hearts, and particularly in those of young animals, Kent's claim that there is more than one muscular auriculo-ventricular connexion has been amply confirmed.

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CONCERNING THE ACTION OF DIGITALIS

Michael Ginsburg, B.Sc., Ph.D.
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In spite of the extraordinary advances that have been made through the therapeutic use of drugs, there is a remarkably large number of drugs which were employed in the 1890's and which have not been superseded. The future of aspirin or amyl nitrite seems secure, and there have been no essential additions to the saline and vegetable laxatives. Despite the synthetic substitutes which have been used, the ancient alkaloids of opium and belladonna remain the most useful agents of their types, though the fruits of recent research may displace them from their pedestals.

Perhaps digitalis and the other cardiac glycosides are the best examples of the "perennial" drugs. When Kent in the 1890's was discovering the conducting tissue which bears his name in the heart, digitalis was used then, as it is now, in the treatment of cardiac dropsy, and its value in this condition has been recognized since 1785. The career of digitalis has been long and varied. Foxglove was mentioned in many of the old herbals and its use as an emetic was sometimes recommended; Culpeper (1616–1654) stated that "Myself am confident that an ointment made of it is one of the best remedies for a scabby head that is."[1] In 1785, Withering[2] described the use of foxglove in dropsy and though he recognized that it had effects on the heart he did not distinguish between cardiac and other forms of œdema. The demonstration of its dramatic effects in some cases of dropsy was followed by a period in the early nineteenth century in which it was used indiscriminately in conditions such as delirium tremens and epilepsy. It seems impossible that the alcohol content of the tincture of digitalis could account for any improvement in these cases. Such uses for digitalis were discredited by the middle of the century and it was shown that its main action was on the heart. At the beginning of the twentieth century, Mackenzie found that one of the effects of digitalis was to depress conduction in the bundle of Kent and that in cases of auricular fibrillation this reduced the stream of impulses passing from auricle to ventricle. The ventricle is thus permitted to beat more slowly and more effectively resulting in an improved circulation.

This finding led to the mistaken belief, particularly in this country, that digitalis was effective in congestive heart failure only when it was associated with auricular fibrillation. In fact, benefit of treatment with digitalis should not be withheld from any patient with congestive heart failure, whatever the cause. It is not implied that digitalis can be regarded as a panacea successful in all cases; that would be as irrational as to recommend liver therapy for all kinds of anæmia.

There are many possible modes of action for digitalis and the simple explanation given by Mackenzie for its effect in auricular fibrillation is only one of them. For example, slowing of the ventricular rate in the early stages of digitalis treatment appears to be vagal in origin since it can be abolished by atropine, in contrast to the direct action in the bundle of Kent which is not abolished by atropine and which appears later. Digitalis has a direct tonic action on the failing myocardium enhancing the force of systolic contraction, and this is probably the most important effect in the relief of congestive heart failure with normal rhythm.

A few years ago the cat was thrown among the pigeons by the suggestion that the primary action of digitalis in congestive heart failure was not on the heart, but somewhere in the peripheral circulation, in such a way that it reduced venous pressure.[3] A vigorous controversy followed,[4] and it is now agreed on all sides that this theory is untenable and that the primary action of digitalis is more likely to be due to direct stimulation of the myocardium, though the consequent fall in venous pressure may further promote cardiac output in the failing heart.[5] That such a hypothesis could have been made seriously within the last ten years is surely a reflection of how confusing and complex are the effects produced by digitalis in the treatment of heart failure, and how little we know of the mechanisms involved.

The changes in blood pressures seen in various parts of the cardiovascular system during the recovery of cardiac output in the effective treatment of congestive heart failure are the resultants of processes which are not understood. In the past fifteen years (and particularly in the last five years) a number of new observations have shown the existence of previously unsuspected reflexes arising from the heart and lungs.[6] It is already clear that the conceptions of the Bainbridge and McDowall reflexes require revision.[7] How important are these newly discovered reflexes in controlling the circulation in congestive heart failure? What rôle do they play in the fall in venous pressure and the rise in cardiac output during recovery from heart failure? Are these reflexes affected by the cardiac glycosides? When these questions are answered perhaps a more complete account of the action of digitalis will be possible; they may throw some light on the even more obscure but undeniable action of morphine in left ventricular failure. One thing is clear—we cannot hope for a single simple explanation to cover the many varieties of heart failure in which digitalis has a beneficial effect. The subject will remain difficult for both student and teacher.

Qualitatively the effects of digitalis on the heart are also shown by the other cardiac glycosides, all of which are natural products from plants which appeared in ancient herbals. There are no modern synthetic drugs with actions comparable to that of the cardiac glycosides. There are many synthetic substitutes for morphine, atropine

and curare but none for digitalis. The demand for such compounds if they were known might not be great. Digitalis is an extremely good drug—its beneficial effect can be dramatic and frequently the appearance of serious toxic effects are a convenient sign of overdosage. But that is no excuse and we must enquire into the reasons for the failure of experimental pharmacology in this field.

Firstly, the effect of the glycosides is conferred by a complex steroid entity in the molecule and the synthesis of analogues (successful in the preparation of atropine and curare substitutes) would be very difficult, probably uneconomical, and so far as I know it has not been attempted. Secondly, it is extremely difficult to design a laboratory test for the screening of compounds of digitalis-like activity. A reliable method of putting the hearts of *intact* experimental animals into congestive heart failure, with and without arrhythmia, and of standard severity is needed. Drugs have been tested on hearts in which arrhythmias had been induced by electrical stimulation, by application of choline esters or aconitine to the myocardium, by administration of barium chloride, and by administering adrenaline to animals in chloroform anæsthesia.[8] But these are not tests for digitalis-like activity since the cardiac glycosides are effective in heart failure with normal rhythm.

The only success of this type of investigation was the demonstration of the action of procaine in cardiac arrhythmias. Procaine reduces the excitability of cardiac muscle and can abolish arrhythmias; that is to say, it acts like quinidine. Favourable reports of its use have appeared in the last year or two and it seems likely that intramuscular procaine amide will supercede quinidine.[9] The essential discovery leading to the use of quinidine is unique in that it was made by a patient. That is one way of overcoming the difficulties in the laboratory screening of drugs, but it is likely to be hazardous.

The old drugs, dear to the hearts of all, still hold the field in the treatment of congestive heart failure. The benefit from their use is usually clear-cut and clinical trials and statistics are not necessary to establish their worth. That is why they have remained in use. The knowledge needed for the conduct of carefully controlled trials has been acquired only recently, and I wonder if the inadequate trials of the recent and distant past rejected as many effective remedies as ineffective remedies they retained? Household vinegar by virtue of its content of an antibiotic has been found effective in some middle ear infection which did not respond to more conventional antibiotics.[10] Did not Jack apply the very same remedy to his broken crown?

For *References* see page 22.

MODERN SURGERY OF THE HEART

R. MILNES WALKER, M.B., M.S., F.R.C.S.
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DURING the last decade there has been no more spectacular advance in surgery than that connected with the heart, and in an organ whose activity is so vital, surgery, both experimental and clinical, must depend on an accurate knowledge of the anatomy and of the physiology. In the past, one of the serious problems has been the disturbance of rhythm which is likely to occur when the heart is handled by surgical instruments. The bundle of Kent is situated in a part of the heart which is hardly accessible to surgery, but attempts have been made to close interatrial septal defects and in such cases the region of the bundle has to be carefully avoided.

The modern epoch of cardiac surgery commenced with the treatment of congenital abnormalities and the operative procedure adopted involved structures outside the heart itself. In 1939 Gross in Boston first successfully closed a patent ductus arteriosus. In 1945 Crafoord, of Stockholm, reported his first two cases of excision of a coarctation of the arch of the aorta with end-to-end anastomosis, and in the same year Blalock in Baltimore described the use of extra-cardiac shunts between the systemic and pulmonary arteries to relieve cases of cyanotic congenital heart disease.

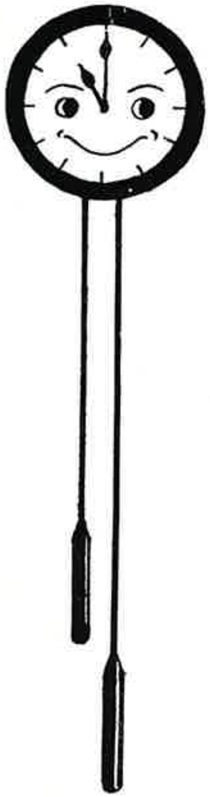
More than twenty years ago a few attempts at intracardiac surgery had been made, for in 1923 Cutler and Levine at Cleveland enlarged the mitral orifice in a case of mitral stenosis by passing a tenotome through the wall of the left ventricle and the patient survived four years. In 1925 Souttar at the London Hospital successfully dilated a mitral valve with a finger inserted through the left atrial appendage, a forerunner of the method which has become standard practice to-day. It is largely due to the pioneer work of Brock at Guy's Hospital since 1948 that surgery inside the heart itself has become practical, and already operations for the relief of pulmonary stenosis and of mitral stenosis by direct approach to the valves themselves have become routine surgical procedures.

The use of local anæsthesia injected into the wall of the heart at the site of operation has gone some way towards reducing the irritability and disturbances of rhythm which add to the hazards of cardiac surgery. However, as a result of much experimental work it is now often possible to restore a heart which has gone into ventricular fibrillation to normal rhythm. In such cases death is usually due to cerebral anoxæmia and this in turn is the result of delay in instituting cardiac massage and restoring some circulation to the brain. The cardiac surgeon is fortunate in that he is in an advantageous position to deal promptly with cardiac arrest or ventricular fibrillation ; in a case of fibrillation

of the ventricles a normal rhythm may occasionally return spontaneously provided the circulation is maintained by cardiac massage, but the use of an electric defibrillator is a great help in restoring normal rhythm—this provides for the passage of a strong electric current through the heart muscle, thus making all its fibres contract simultaneously. It is now well established that with proper cardiac massage an adequate circulation can be maintained and we ourselves have had one case in which cardiac arrest occurred for twenty-two minutes, but full recovery followed without any evidence of cerebral damage.

At the present time much experimental work is proceeding in connexion with other cardiac abnormalities. As already mentioned, attempts have been made to close interatrial defects by passing stitches through the heart from front to back, thus drawing the margins of the defect together. Tricuspid atresia has been treated by creating a defect in the interatrial septum. Mitral regurgitation has been dealt with by implanting grafts as valves into the heart, and aortic stenosis has been tackled by a direct approach. Similarly, attempts have been made—both experimentally and in man—to improve the cardiac blood supply in cases of coronary artery disease by the anastomosis of other arteries to the coronary sinus. These attempts are hampered by the need to maintain the patient's circulation while the intracardiac manipulations are being carried out and there is need of a temporary artificial pump which could be connected to the patient's circulation. Many methods have been tried : the use of the heart or the heart and lungs of another animal, a mechanical pump with or without means of oxygenating the blood, or the lowering of the temperature of the patient to such an extent that the oxygen requirements are reduced to a minimum so that the brain can survive for a longer period while the circulation is arrested. All these methods require highly skilled technical work, and though they have on a few occasions been used for operations on human beings they all carry great hazards. Until such means of maintaining the circulation can be greatly simplified there is not likely to be much more technical progress in surgical operations on the heart itself.

COFFEE TIME



Plumb Right

A man brought into Casualty with his head shot to pieces was said to have died of lead poisoning.

Brass Plate in Bristol

J. H. BALDWIN, Trichologist.

High Powered

LABORATORY REQUEST FORM :—

Consultant : Dr. C-- b —l.

Diagnosis : ? Cerebral tumour.

Relevant Clinical Features : Sore throat.

The Cold War

Under the impression that his one-time dresser was now doing P.M.'s, Mr. C—r remarked, " From the Hall of the Living to the Hall of the Dead, I see! " " Oh no, sir," replied the student, " I am now on the Medical side." Mr. C—r (with obvious disgust) : " Same thing."

Physician (to a group of students) : " If a G.P. had sent a patient up to out-patients' with a urinary infection before the days of sulphonamides, how would you have written to him advising him on treatment? "

H.P. (*sotto voce*) : " Thank you for sending me this most interesting case. . . ."

Prof. P—y (to clerk on first round of new firm) : " What is the matter with this patient? "

(A pause) : " Rheumatic heart disease."

Prof. P —y : " NO! "

(A longer pause) : " Diabetes mellitus, sir."

Prof. P—y : " NO! NO! Good gracious, boy, where have you been since you came on the firm? "

Dead Right

Answering a question as to why the patient had not been weighed during her illness, Mr. M—r said, " It being necessary to keep the patient in a recumbent position we found it impossible, because no such weighing machine is at our disposal."

Prof. H—r : " Oh, but *I* have one."

SOCIAL EVENTS

Marriages

Mr. Raymond Ramsey, F.R.C.S., to Miss Lilian Bateman, at Bath, on October 4th, 1952.

Dr. Phillip Norris to Miss Juliet Stanley, at Bristol, on December 20th, 1952.

Mr. David Felton to Miss Margaret Hadley, at Bristol, on January 10th, 1953.

Engagements

Mr. Mervyn T. Charleston to Miss Velma E. Rubie.

Mr. F. D. Fisher to Miss Pamela Atkinson.

Dr. R. A. Iles to Sister Pamela Jennison.

Mr. Robert McCormick to Miss Angela M. Ainger.

Mr. James Henry Williams to Miss Dorothy Jean Ingham.

B.M.S.A. NEWS

Holiday in France : If you would like a holiday in France this year, arrangements can be made for you to stay as the guests of doctors in Lille. You will be accommodated free of charge and have an opportunity of seeing general practice in France as well as the new medical school in Lille, which is the most modern in France. You will be quite free to do as you choose—Paris is within easy reach—and the medical students will be pleased to entertain you. It is advisable that you should know a little French, though this is not essential. The only cost to you will be the train fare (and boat fare). There's no catch—the invitation is a genuine one—and if you would like to go, contact your Galenicals or B.M.S.A. representative NOW, because the arrangements will take time to make. Early July is the time suggested by the Lille organizer, but if this is inconvenient it may be possible to arrange a different time if you apply early.

UNION PRESIDENT

Derek Zutshi (Fourth Year), now serving on Union Council as N.U.S. Secretary, is standing for President of the Union at the end of this term. This is the first time for many years that a Medical student has stood for this office, so that it is even more important that we actively support him. Polling booths will be placed in the Royal Infirmary.

Editorial Committee

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EDITORIAL

MAN'S expectation of life is lengthening, it seems, but ninety is still a very good innings. On March 26th, 1953, *Dr. Albert Frank Stanley Kent* joins the comparatively short list of nonagenarians. Thus a one-time Professor of Physiology in the University of Bristol gives us the opportunity of acknowledging his ninetieth birthday—to him we dedicate this Number of BLACK BAG.

That a man, whose research into the *Conducting System of the Human Heart* and *Industrial Fatigue*, and whose active support and administration were vital in the formation of a *University of Bristol*, has lived to see his work bear fruit, must be most gratifying. Within the pages of this Number, then, we have collected a series of articles, including one by Dr. Kent himself, which we are pleased to print with all respect and due appreciation to one whose name and work are established in cardiac circles generally and particularly in Bristol.

We wish to thank all our contributors and especially Dr. Harry Sosnowick whose initiative and suggestions have made this Number possible.